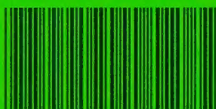


PRELIMINARY
OPERATING INSTRUCTIONS
FOR
SRL SERIES
LOW VOLTAGE POWER SUPPLIES

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SORENSEN POWER SUPPLIES
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MA25543

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PRELIMINARY

OPERATING INSTRUCTIONS

1. GENERAL.
2. In this preliminary issue, operating procedures presented include remote sensing and voltage- and current-mode programming. A description of controls and indicators is also provided (Table 1).
3. VOLTAGE-MODE OPERATION.
4. LOCAL SENSING. All models in the SRL series are shipped ready for use with local sensing, i.e., sensing point is at the output terminals. If variations in load-lead drops are expected to be high relative to unit's specified regulation, remote sensing should be used (paragraph 6).
5. To operate unit in local sensing, proceed as follows:
 - a. To set current-limit value, short the unit output terminals, set power switch to ON, and use current control to adjust current-limit value, indicated on ammeter.
 - b. Set power switch to OFF, remove short.
 - c. Apply input power, and rotate coarse and fine voltage controls to obtain desired output. Set power switch to OFF.
 - d. Observing polarity, run load leads to either front or rear output terminals (at rear terminals, link should be fitted between binder screw head and lead); then re-apply input. Unit supplies power to load, with output voltage regulated at unit terminals.
6. REMOTE SENSING: To adapt unit for remote-sensing operation, follow procedures outlined in paragraph 5, but before setting power switch to ON, remove links between terminals TB3-1 and TB2-5 and TB3-3 and TB2-6. Then connect sensing leads, observing polarity to TB2-5 & 6. Use coaxial cable or a twisted pair of wires for sensing leads and make certain that leads are firmly connected, both at unit terminals and load. Current in the sensing leads is below 100 mA. In remote-sensing standard-programming operation, transient-response characteristics may degenerate slightly.
7. REMOTE PROGRAMMING. In voltage-mode, remote-programming operation, unit output voltage is controlled by external resistance or voltage-signal commands. Both types may be used.



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TABLE I-SRL PANEL CONTROLS/INDICATORS

<u>Control</u>	<u>Function</u>
DC VOLTS Meter (M1)	Provides direct readout of voltage selected by voltage controls.
DC AMPERES Meter (M2)	Provides direct readout of load current.
VOLTAGE Controls (R53A, R53B)	Provide coarse and fine adjustment of output voltage.
CURRENT Controls (R18A, R18B)	Provide coarse and fine adjustment of output current.
POWER Switch (CB1/S1)	Used to connect or disconnect a.c. line voltage to primary of transformer T1.
POWER Light (DS1)	Illuminates when POWER switch is in the ON position.
OVERVOLTAGE ADJ (R85)	Recessed potentiometer to adjust trip level of overvoltage circuit.
OVERVOLTAGE SET (S2)	Momentary toggle switch, when depressed causes panel dc VOLTS meter to indicate overvoltage trip level.

8. Resistance Programming. If the output voltage is to be controlled by resistance programming, calculate the resistance required using the ratio at $200 \pm 0.5\%$ ohms/volts, i.e., for every volt of output desired approximately 200 ohms are required. In selecting a programming resistor, choose one with a low temperature coefficient (± 20 ppm/ $^{\circ}\text{C}$) and a wattage ten times that calculated (programming current is normally 5 mA). Note that resistance programming may also be used to improve the unit drift characteristic. For example, if a fixed output is required, a fixed resistor may be selected. This eliminates the variable contact resistance which is inherent in any potentiometer and which contributes to the drift characteristic. If abrupt changes in output voltage are to be made by switching the programming resistance, use a make-before-break switch.
9. To adapt unit to resistance programming, proceed as follows:
 - a. Short unit output terminals, set power switch to ON, Use the current control to adjust current-limit value.
 - b. Set power switch to OFF, remove short.
 - c. Rotate voltage controls fully counterclockwise.
 - d. Remove link between terminals TB2-3 and TB2-4, and connect programming resistor. Use twisted or shielded wire for leads.

NOTES

1. Operating the unit with open programming leads or links may result in either low or high output voltage.
2. With programming resistor connected across terminals TB2-3 and TB2-4, voltage control remains in circuit. Rotation of this control will alter programmed voltage. If this is an undesirable feature, connect resistor across terminals 3 and 6 effect complete bypass.

10. Changing of Programming Constant. If it becomes necessary to change the programming constant, the value of R21 (programming constant resistor) may be determined as in the following example:

Example: To change the programming coefficient (Pc) from 200 ohms/volt to 1000 ohms/volt, calculate the new value of R21:

$$R21 = V_{ref} \times P_c$$

where V_{ref} is the voltage across C11 (approximately 9 volts).
Thus;

$$R21 = 9 \text{ volts} \times 1000 \text{ ohms/volt} = 9000 \text{ ohms}$$

The current through R21 is then: $\frac{9 \text{ volts}}{9000 \text{ ohms}} = 1 \text{ milliampere.}$

As noted before, the programming resistor should have a low temperature coefficient, and a wattage rating ten times that of the calculated rating.

11. To adapt unit to a different resistance programming constant, proceed as follows:
- Rotate voltage controls fully counterclockwise.
 - Remove the link between TB2-3 and TB2-4. Install programming constant resistor R21 between TB2-1 and TB2-3 and adjust V_{ref} until the ratio of $V_{ref}/R21$ is exactly 1 milliampere, or the calculated reference current. This can be done by inserting a resistor in place of R53A equal to $E_{out \text{ max}}/1 \text{ mA}$ and adjusting the voltage reference potentiometer R9 until E_{out} is exactly equal to $E_{out \text{ max}}$.

Deterioration of the voltage regulation will occur as the programming constant is increased due to the effect of offset current, and will be proportional to the increase of R21. As an example, if the contribution due to offset current at 200 ohms/volt is 0.002% then at 1000 ohms/volt, approximately 0.01% might be expected.

12. Voltage Signal Programming. To adapt unit for voltage signal programming proceed as follows:

a. Unity Gain (1V/V)

- 1) Remove the input power.
- 2) Remove the link between TB2-2 and TB2-3.
- 3) Remove the link between TB2-3 and TB2-4.
- 4) Connect the signal programming source between TB2-3 and TB2-6. Observe the proper polarity of signal source (minus) on TB2-6.
- 5) With this modification, the SRL will produce a one volt output for one volt of signal. Do not exceed the rated output voltage of the SRL.

The stability and regulation will be a function of the signal source stability. The signal source output impedance must be low if the effects of offset current are to be neglected.

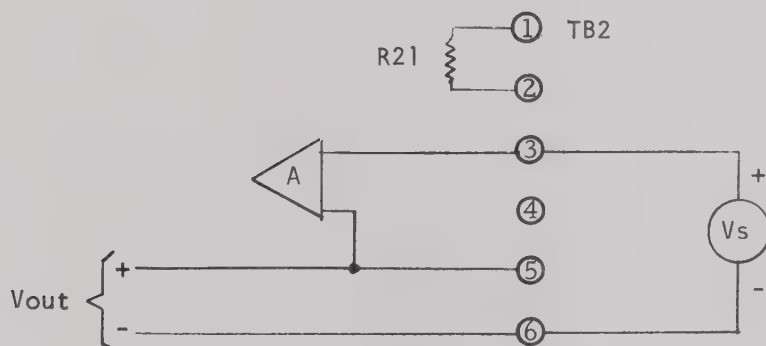


FIGURE 1 UNITY GAIN

b. Variable Gain

- 1) Remove the link between TB2-2 and TB2-3.
- 2) Remove the link between TB2-3 and TB2-4.
- 3) Place Ri (1.78K suggested) in series with the signal source and connect as shown in Figure 2 between TB2-3 and TB2-5 observing the proper polarity.

- 4) As with the previous method of programming, stability will be a function of the signal source stability, its internal impedance, and the stability of R_i and R_p .

In this mode of operation $V_o = V_s R_p/R_i$ assuming the effects of amplifier offset and signal source impedance are negligible. Thus the gain is determined by the ratio R_p/R_i . It is suggested that R_i be made equal to 1.78K ohm or less to minimize the effect of offset voltage. R_i and R_p should be stable resistors (20 ppm/°C or less). Note that the front panel voltage control R53 may be substituted for R_p if TB2-3 and TB2-4 are linked.

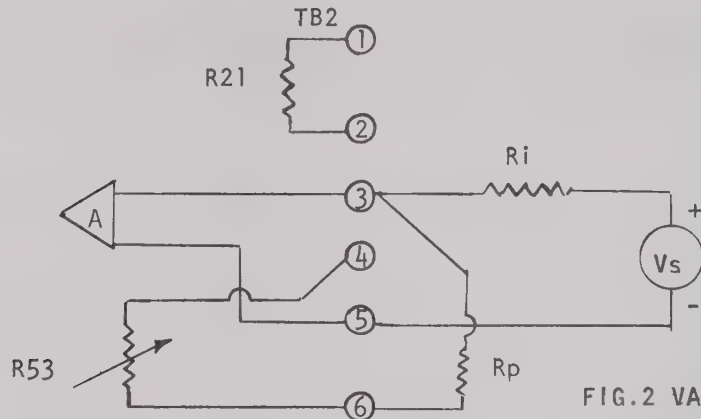


FIG. 2 VARIABLE GAIN

13. CURRENT-MODE OPERATION.

14. To operate an SRL unit in the current mode, proceed as follows:
- Rotate all front panel controls fully counterclockwise.
 - Short the output terminals.
 - Rotate fine voltage control clockwise, and close power switch.
 - Turn coarse and fine current controls clockwise to select the desired output current.
 - Open power switch and remove short from output terminals.
 - Set power switch to ON and adjust output voltage, using voltage control, to desired compliance setting.
 - Open power switch, and observing polarity, connect load to terminals TB3-1 and 3. Re-apply input power.

NOTE

If compliance voltage exceeds voltage control setting, crossover to voltage-mode operation occurs automatically.

15. REMOTE PROGRAMMING. In current-mode, remote-programming operation, the regulated output current may be controlled externally by resistance changes or voltage signals.
16. Resistance. For resistance programming, calculate the value of resistor required by using the ohms/ampere coefficient listed in Table II.

TABLE II
PROGRAMMING CONSTANTS
(CURRENT MODE)

SRL MODEL	RESISTIVE OHMS/AMP ($\pm 10\%$)	VOLTAGE MILLIVOLTS/AMP ($\pm 10\%$)
10-25	40	20
10-50	20	8
10-100	10	2.5
20-12	80	80
20-25	40	20
20-50	20	8
40-6	150	150
40-12	80	80
40-25	40	20
40-50	20	8
60-4	250	250
60-8	125	125
60-17	60	40
60-35	28	15

NOTE: Use a resistor with a low temperature coefficient (± 20 ppm/ $^{\circ}\text{C}$), and a wattage rating at least ten times calculated value (normal programming current is approximately 1 mA).

17. To adapt unit for current-mode, resistance-programming operation, proceed as follows:
 - a. Close power switch, adjust output voltage to desired compliance setting.
 - b. Open power switch, and rotate current controls fully counterclockwise.
 - c. Remove link between terminals TB2-7 and 8, and replace with programming resistor.

CAUTION

Operating unit with open programming leads or links will result in high output current with possible crossover to voltage mode. If step changes in output current are to be made by abrupt resistance alterations, use make-before-break switching.

- d. Run load leads to terminals TB3-1 and 3, observing polarity.
- e. Set power switch to ON. Unit supplies regulated programmed current to the load.

NOTE

Any rotation of the current control alters the output current.

- 18. Voltage Signal. To adapt an SRL unit to voltage-signal programming, follow procedures outlined in paragraph 17, except connect signal-producing device across terminals TB2-7 and 8, instead of the programming resistor. The programming device should be floating (ungrounded), be capable of absorbing the 1 mA programming current, and have a low-noise, low-ripple output signal.

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